

Use of Magnetic Bacteria to Remove Phosphorus from Eutrophic Waters

Ashlee Balcerzak, Steven Lower, Eric Mumper

INTRODUCTION

Eutrophication or excess nutrients in rivers or lakes is a problem in the Midwest commonly caused by high levels of phosphorus in runoff from agriculture. Magnetotactic bacteria (MTB), magnetite-containing microorganisms found in aquatic ecosystems, that contain inclusions of phosphorus. This study tests whether MTB can be used to remove phosphorus concentrations from eutrophic conditions. MTB may have some capability to remove phosphorus from water environments, offering a microbiological solution in places where eutrophication occurs.



Figure 1. Lake Erie's western basin is one example of where eutrophication occurs. Satellite images can even show the span of the blooms. Photo courtesy: NASA

METHODS

Methods include:

- Growing the type strain of MTB, *Magnetospirillum magneticum*, AMB-1 media over five days spiked with phosphorus concentrations at 0.01 mg/L (low phosphorus), 0.025 mg/L (medium phosphorus), and 0.06 mg/L (high phosphorus).
- Controls of dead cells
- Centrifuge usage to separate the cells from the media
- Colorimetric analysis to measure phosphorus in solution

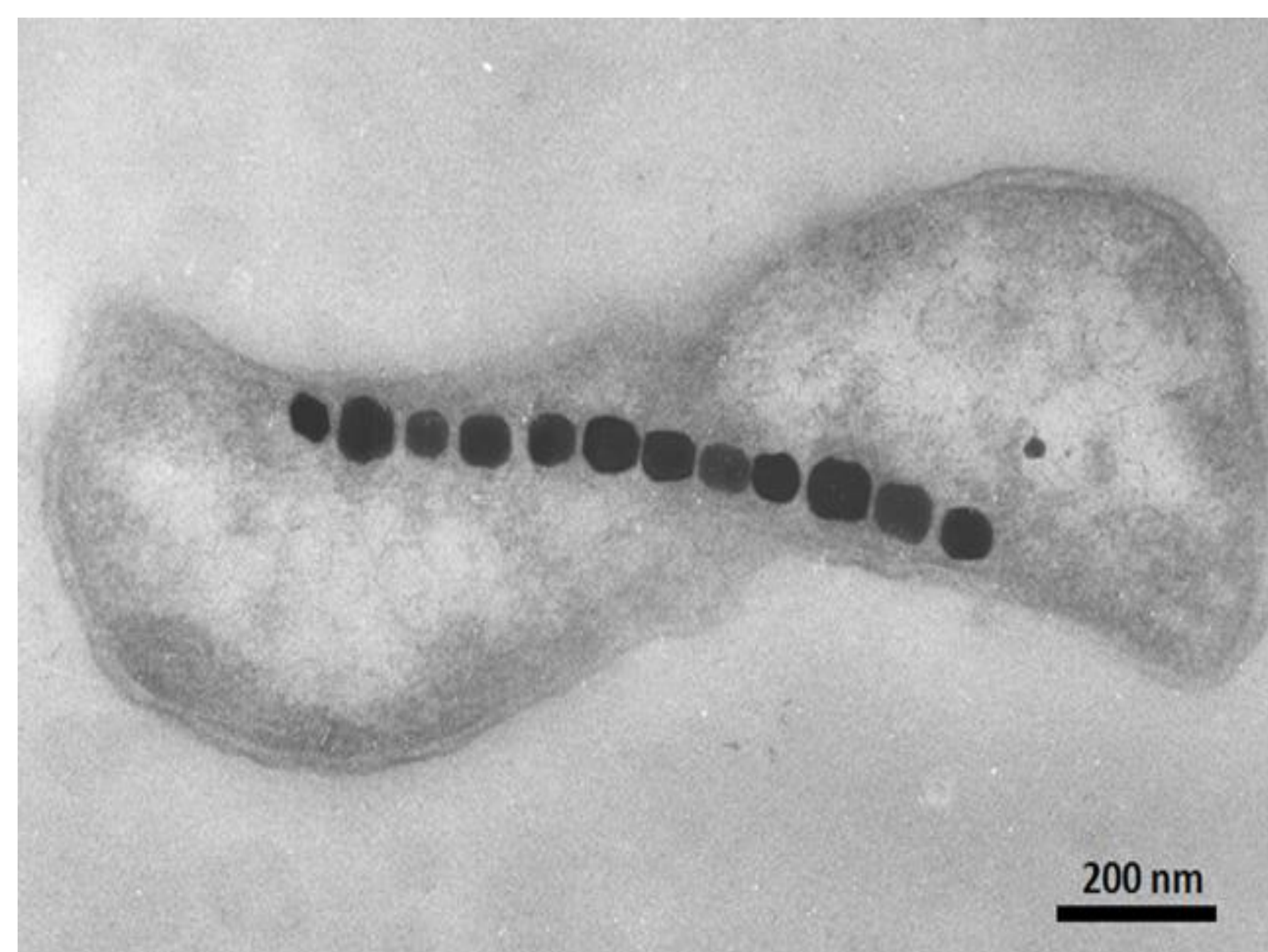


Figure 2. Image of MTB. Chain like circles inside the bacterium are magnetosomes, magnetic components of the cell. Photo courtesy: L. Chen, D. Bazylinski & B. Lower

RESULTS

Results thus far indicate:

- Concentrations of phosphorus decrease in the media after two days when phosphorus containing media is inoculated.
- Samples with higher concentrations of phosphorus experience more rapid decreases in solution phase phosphorus.
- Phosphorus was recovered from the cell pellet
- In low concentrations, AMB-1 significantly removed phosphorus ($t=-2.57$, $p<0.05$, $n=6$)
- In medium concentrations, AMB-1 significantly removed phosphorus ($t=-3.17$, $p<0.05$, $n=6$)
- In high concentrations, AMB-1 did not significantly removed phosphorus
- When comparing low and high solution phosphorus concentrations, there was a significance ($t=-2.63$, $p<0.05$, $n=6$)

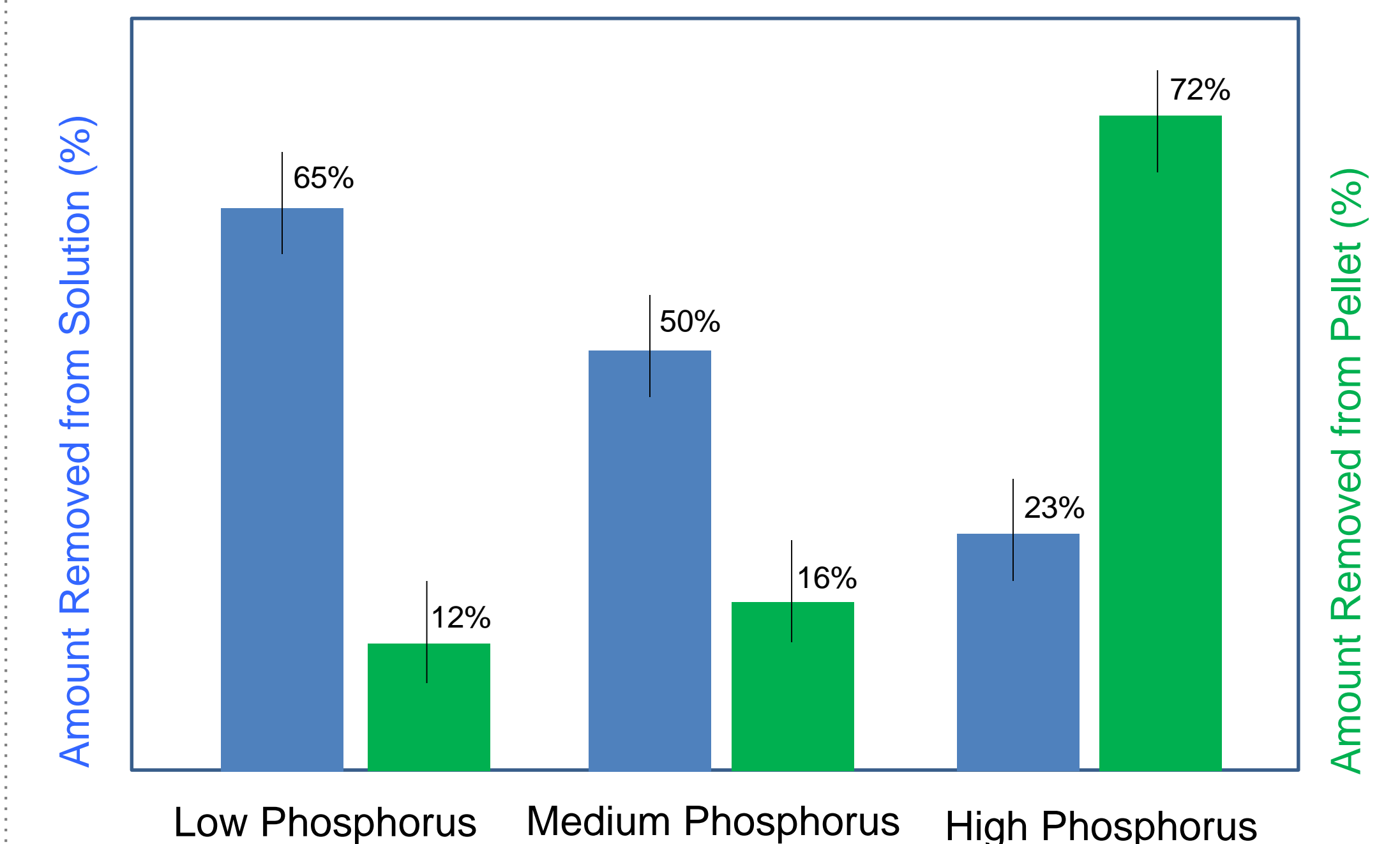


Figure 3. This represents the amount of phosphorus removed from the supernatant and pellet for each of the phosphorus concentrations.

CONCLUSIONS

While initial results support phosphorus removal, additional replications are needed to determine efficiency under different phosphorus concentrations.

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